DOCUMENT RESUME

ED 401 379 CE 071 253

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TITLE Phoenix Closures, Inc. Curriculum. Workplace Pre Algebra. Worker Education Program.
INSTITUTION Amalgamated Clothing and Textile Workers Union, Chicago, IL.; Northeastern Illinois Univ., Chicago. Chicago Teachers' Center.
SPONS AGENCY Office of Vocational and Adult Education (ED), Washington, DC. National Workplace Literacy Program.
PUB DATE 95
NOTE 18p.; For related documents, see ED 379 954-957, ED 391 396-400, ED 392 309-310, and CE 071 252.
PUB TYPE Guides - Classroom Use - Teaching Guides (For Teacher) (052)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Adult Education; Arithmetic; *Basic Skills; Behavioral Objectives; *Competency Based Education; *Equations (Mathematics); Learning Activities; Lesson Plans; *Mathematics Skills; *Problem Solving; *Workplace Literacy
IDENTIFIERS *Pre Algebra

ABSTRACT

This document contains the lesson plans for a 12-week course in basic workplace pre-algebra that was developed for clothing and textile workers through the joint effort of Northeastern Illinois University's Chicago Teachers' Center and the Amalgamated Clothing and Textile Workers Union. A chart for recording students' mastery of 25 course objectives is provided. The following activities are completed in the 12 course sessions: making introductions (including beginning a placement inventory test and exploring personal learning styles); completing the placement inventory test and reviewing results; introducing signed numbers and adding and subtracting them; multiplying and dividing signed numbers; using more than one operation with signed numbers; solving equations (defining variables and evaluating algebraic expressions); solving equations with one or two inverse operations; combining like variables; combining variables to solve equations; solving equations with variables on both sides of the equation; solving literal equations; and reviewing concepts and algebraic language for posttesting. The lesson plan included for each unit contains the following: objectives, learning activities, evaluation activities and criteria, and reinforcement activity. (MN)

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ED 401 379

# Phoenix Closures, Inc.

## Curriculum • Workplace Pre Algebra

Worker Education Program
Chicago Teachers' Center of Northeastern Illinois University &
the Amalgamated Clothing and Textile Workers Union

Submitted by: Virginia Trusiak
January 1995

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
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# PRE ALGEBRA

**THURSDAYS 4:15PM—>5:45PM**
**Jan. 5, —>Mar. 23, 1995**

Instructor:
Contact:

Text "Breakthrough to Math" Level 3

Week 1 Introductions
- Review course objectives
- Begin placement inventory test
- Explore personal learning style by completing the worksheet
- Select topics for future classes

Week 2 Complete placement inventory test and review results
- Work on an algebraic expression that explains conversions to metric from US standard measurements

Week 3 Introduction to signed numbers and use in basic operations
- Adding and Subtracting

Week 4 Signed Numbers--Multiplying and Dividing

Week 5 Using more than one operation with signed umbers

Week 6 Solving equations
- Defining variables, expressions, equations
- Evaluating algebraic expressions

Week 7 Solving equations
- Solving Equations with one inverse operation
- Solving Equations with two inverse operations

Week 8 Combining like variables

Week 9 Combining variables to solve equations

Week 10 Solving equations with variables on both sides of the equation

Week 11 Solving literal equations (no numerals)

Week 12 Review concepts and algebraic lanaguage for post testing

***Class Objectives and Student Progress Report***

| OBJECTIVES | NO | Some What | YES | EXPLANATION |
|---|---|---|---|---|
| To know and realize the reason for MATH review | | | | |
| To reveal personal learning style for MATH | | | | |
| To realize which areas of basic math need to be reviewed | | | | |
| To develop a basic alebraic formula | | | | |
| To identify signed numbers | | | | |
| To add and subtract signed numbers | | | | |
| To multiply and divide signed numbers | | | | |
| To determine the appropriate order of operations | | | | |
| addition | | | | |
| subtraction | | | | |
| multiplication | | | | |
| division | | | | |

WORKPLACE .PRE ALGEBRA
at Phoenix Closures, Inc.

WEEK 1: January 5, 1995

*Objectives:*

To enable the participants to acknowledge their math phobia and evlauate how much they need to review.

To select which areas of math they feel they need to review.

*Activities:* (in terms of the actions of the participants)

Introduce yourself to instructor and other members of the class. Establish classroom procedures, discuss time schedule and delivery of assignments. (5 mins.)

Review topics of course and select those that would be interesting to explore during the next twelve weeks. (25 mins.)

Begin to complete the ten page personal inventory of basic math concepts for use as a placement device. (45 mins.)

Review the best test taking techques that can be used to perform your best. (10 mins.)

Complete the numerical discrimination pretest in the shortest possible time. (5 mins.)

*Evaluation:* (in terms of teachers actions)

Interpret selections of topics which seemed to most relevant to the participants. Evaluate the participants; related impression of their personal learning style.

Check and record data from the computation and discrimination pretest.

*Reinforcement:*

Return to class session with a list of everyday and on the job uses for math computation and comprehension.

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WEEK 2: January 12, 1995

*Objectives:*

To explore and recognize ones own personal learning style.
To develop an algebraic formula for conversion of imperial measurements to metric.

*Activities:*

Complete the personal inventory test. Check over the problems. Make a list of the type of problem that seemed difficult or confusing. Discuss these problems with the instructor. (45 mins.)

With a partner make a list of the different measurements that are used in the factory. Group them according to whether they quantify length or temperature. (15 mins.)

Develop a formula that actually can be algebraic to determine the conversion of imperial measurements to metric. (25 mins.)

With a different partner select an object to measure to prove the formula. (15 mins.)

*Evaluation:*

Check and record data from the completed inventory. See if the results match the particpants perception of how well they remember basic math concepts.

*Reinforcement:*

Complete worksheets about measurements from Understanding Measurement by Taylor and Taylor.

WORKPLACE PRE-ALGEBRA
at Phoenix Closures
WEEK 3: January 19, 1995

*Objectives*:

To identify positive and negative numbers on a number line.
To add with same signed numbers
To add with different signed numbers.
To add two or more different signed numbers

*Activities:*

Complete a pretest about signed numbers. (5 mins.)
Create a number line and locate various signed numbers on it. It can be either vertical or horizontal. With a partner direct each other to take positions on a horizontal line; take turns ( 5 mins.)
Demonstrate to the larger group how to show the addition of two positive numbers using a number line or a graph or a chart. (10 mins.)
Practice adding different signed numbers. Demonstrate the addition of negative numbers to a number line or graph or a chart. (10 mins.)
Practice adding a series of same signed numbers. Use parentheses to distinguish them from the operation sign. (15 mins.)
Practice adding more than one number in the parentheses. Combine numbers in the parenthese to make addition easier. (20 mins.)
Create a flow chart to show the order of steps to be taken to solve problems using numbers with different signs.( 20 mins.)

*Evaluation*:

Create a workplace word problem that uses signed numbers. For example a weekly collection of tolerance levels for product conformance with customer specifications. (5 mins.)

*Reinforcement:*

Complete practice pages:8,13,18 from Breakthrough to Math–Signed Numbers

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Week 4: January 26, 1995

*Objectives:*

To subtract signed numbers.
To learn the interpretations for the symbols used on a flow chart.
To develop a flow chart that depicts the steps to manipulate signed numbers.

*Activities:*

Complete the placement inventory or review concepts covered last week for those who were absent . (10 mins.)
Review the concept that subtraction means to find the difference between two quantities. Use a number line and show subtraction. Use parentheses to contain the quantity with its sign. Change the sign of the subtrahend and then add it to the minuend. Follow the rules that apply to addition of signed number. (30 mins.)
Subtract more than two signed numbers. Change the sign of the each of the numbers following the subtraction operation sign. (10 mins.)
Check results of subtraction by adding the remainder with either the minuend or the subtrahend.(5 mins.)
Learn the symbols used in simple flow charts. (5 mins.)
In small groups try to develop a flow chart that helps to depict the steps to obtain an answer in a signed number problem. (20 mins)
Exchange flow charts with other groups and experiment with directions given in each. (10 mins.)

*Evaluation:*

After exchange of flow charts develop a chart that encompasses all good aspects of each . Reach a consensus of the most understandable.

*Reinforcement:*

Complete book and worksheet exercises 5 & 6.

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at Phoenix Closures, Inc.

WEEK 5: February 2, 1995

*Objectives:*

To multiply signed numbers
To divide signed numbers
To multiply more than two signed numbers
To develop an order of operation rule for multiplying and dividing signed numbers

*Activities:*

Warm up: Discuss the use of signed numbers and inventory control. Create a workplace word problem using addition or subtraction and then multiplying.(15 mins.)

Define the use of parentheses to show multiplication and differentiation of signed numbers. Multiply a set of integers with same signs and then with different signs. Multiply the numbers without parentheses. Note the different answers. (30 mins.)

Multiply more than two signed numbers. Create a "goal post " diagram to perform the operation step by step. (15 mins.)

Divide signed numbers using rules created for multiplication of signed numbers (15 mins.)

Begin to use more than one operation to reach an answer. Develop an order of operation by first combining the numbers in the parentheses, multiply, reduce fractions by dividing, subtract and then add.(15 mins.)

*Evaluation:*

Select an operation to create a "goal post" diagram.

*Reinforcement:*

Complete exercises and worksheets 7,8,9, & 10 in Breakthrough to Math

WORKPLACE PRE ALGEBRA
at Phoenix Closures, Inc.

WEEK 6: February 9, 1995

Objectives:

To manipulate various signed number operations
To prioritize the operations using parenthesis and signed numbers.
To self evaluate their understanding of signed numbers.

Activities:

Present problems that may be considered confusing from the home work about the multiplication and division of signed numbers.(20 mins.)

Working in pairs participants complete the problems from the post test quiz presented in the text book. Present their method on the board for the entire group. (30 mins.)

Develop a "rule" for prioritizing of the order of operations for signed numbers in and outside of the parenthesis. (15 mins.)

Evaluations:

As individuals participants complete the original developed post test for the first book.(25 mins.) [This test needs to be completed in class but a copy can be taken home.]

Reinforcement:

Participants will complete their text book and review the post test at their leisure.

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WEEK 7: February 16, 1995

*Objectives:*

To define the variables to be manipulated in an equation ,
To assign letters to the unknown quantities
To read algebraic expressions
To write algebraic expressions
To transform workplace problems into algebraic equations

*Activities:*

*Warm up: Complete the post test for Breakthrough to Math Book 1 and self evaluate the results. Complete the pre test for the Book 2 of Breakthrough to Math: Book 2 (30 mins.)*

Review the symbols used in mathematics to represent the four operations. Substitute one letter for the unknown answer or component of an operation. Substitute another letter for any other unknown quantity.(15 mins.)

Read the literal expressions and substitute a workplace situation that is relevant to the production projections for a department in the factory. (30 mins.)

Restate a rule about numbers that can be stated in an algebraic expression. For example: Add 1 to an even number and the result is an odd number. If $x$ =1 then 4+ $x$ =4 +1 and the result must be an odd number. (15 mins)

*Evaluation:*

Review the results of both the pre and post test. Discuss the best method for improvement. Suggest methods to overcome the barriers that are complicating their individual success.

*Reinforcement:*

Complete exercise 1A and 1B and Worksheet 11 from Breakthrough to Math Book 2

WORKPLACE PRE ALGEBRA
at Phoenix Closures, Inc.

WEEK 8: February 23, 1995

*Objectives:*

To know the order of operations
To evaluate an algebraic expression using more than one operation.
To transform workplace problems into algebraic equations

*Activities:*

*Warm up: Review the addition of signed numbers to help with the addition or combining of signed equivalents in algebraic expressions.(10 mins.)*
Assign a quantity to the literal terms. Locate the parentheses in an equation combine the quantities in the parentheses . Perform the multiplication first and then the division. Complete the addition or subtraction to find the answer. (25 mins.)
Working in two groups and using the expressions on Worksheet 12 from *Breakthrough to Math : Level 3* substitute quantities for the literal terms. Display problems at board for the entire group. Work on defense of results. (25 mins.)
Substitute a workplace situation that is relevant to the shipping department of the factory. In small groups or pairs write a word problem for this situation (30 mins.)
Restate a rule about numbers that can be stated in an algebraic expression. For example: Add 1 to an even number and the result is an odd number. If $x = 1$ then $4 + x = 4 + 1$ and the result must be an odd number. (15 mins)

*Evaluation:*

Use worksheet 12 as evidence of mastery. Edit word problems .

*Reinforcement:*

Complete Worksheet 13 from Breakthrough to Math Book 2

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at Phoenix Closures, Inc.

WEEK 9: March 2, 1995

*Objectives:*

To understand the equality of equations
To develop a system to maintain the balance of any equation
To use inverse operations to produce a balanced equation

*Activities:*

*Warm up: Review the subtraction of signed numbers to help with the combining of signed equivalents in algebraic expressions. Use the inverse operation(10 mins.)*
In pairs list the inverse operations for addition, subtraction, multiplication and division. Give a few examples of how this type of operation checking is used at work. Read Chapter 4 of Breakthrough to Math: Solving Equation pages 19–>22. Review practice problems and remember to include the signed numbers and follow the rules governing them. Complete the worksheet , entitled *Inverse Operations.*(30 mins.)

Substitute a workplace situation that is relevant to the production department of the factory. In small groups or pairs write a word problem for this situation (30 mins.)

Restate a rule about zero that can be stated in an algebraic expression. For example: Add 0 to or subtract 0 from any number and the answer will always be that number. $0 + x = x$. $x - 0 = x$. Multiply 0 to any number the answer is equal to 0. If $x = 0$ then $4x = 0$.(15 mins)

*Evaluation:*

Edit worksheet about workplace word problems.

*Reinforcement:*

Complete Worksheet 14 from Breakthrough to Math Book 2

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WEEK 10: March 9, 1995

*Objectives:*

To solve equations with two inverse operations
To know the order of operations [add/subtract ; multiply/divide]
To develop a "check" for proof of correctness
To create a workplace application of algebra

*Activities:*

*Warm up: Review the multiplication of signed numbers to help with the combining of signed equivalents in algebraic expressions. Use the inverse operation(10 mins.)*

As a large group review Problems from Worksheet 14. Present selected problems at the board for the entire group to view.. Give a few examples of how this type of operation checking is used at work. Read Chapter 5 of Breakthrough to Math: Solving Equation pages 25-26. Review practice problems and remember to include the signed numbers and follow the rules governing them. (30 mins.)
Working in pairs with selected partners develop a workplace application for algebra. Complete the form giving the area of concern the description of the situation and an algebraic expression. Show the computation if necessary. Exchange the charts with the others and critique each. Combine outstanding features of each and develop one for the entire class. (30 mins.)

Working as one large group begin to develop a workplace word problem . Edit the written description to help make the problem less confusing. (20 mins.)

*Evaluation:*

Evaluate the workplace word problem chart.

*Reinforcement:*

Complete Worksheet 15 from Breakthrough to Math Book 2

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WEEK 11: March 16, 1995

*Objectives:* To recognize and combine like variables
To express variables with the coefficient of one should be expressed without a numeral coefficient.
To combine variables to solve equations.
To develop a rule for the order of operations.

*Activities:* Read the discussion of like variables on pages 29-30 of Breakthrough to Math Book 3. Make comparisons with other variables at the workplace that can not be combined. Define the terms: ***coefficient*** and ***factor.*** Review the concepts that apply to multiplying most factors and their coefficients. Review the combining of signed numbers. (25 mins.)

Complete the practice problems on page 31. Check the answers and review any problems.( 5 mins.)

Read the discussion on page 33. Define the terms: ***distributive property*** and ***additive inverse*** Apply their rules to the combining of like variables to solve equations. Complete page 37 and check answers. (40 mins.)

Working in pairs create student generated problems using unlike variables. Exchange problems with other group. Try to solve and discuss those points that seem to be confusing or unworkable. (20 mins.)

*Evaluation:* Review student generated problems.

*Reinforcements:* For homework complete worksheets 16 and 17.

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Week 12: March 23, 1995

*Objectives:* To combine like variables and combine numerical values.
To employ the additive inverse to clear one side of the equation.
To know to "sort" numerals and variables to initiate the solution of the equation.
To identify the "question" in a literal equation.
To solve a literal equation.

*Activities:* Inspect the problems on page 39 of Breakthrough to Math Book 3 and highlight the variables. Decide if they are alike or unlike. Use the rule for additive inverse to get the variables on one side of the equation. Use the same rule to get the numerical values on the other side. Solve the equation. Try solving the equations on pages 40-41. Review any difficulties.(40 mins.)

Read the discussion on pages 43-44. Decide what needs to be solved. Decide which unknown needs an answer. Complete the exercises on page 45. (40 mins.)

Working in small groups of 3 or 4 try to substitute a numerical value for one or more unknowns. Critique your efforts. Discuss which number could be used and if the signs of operations could be changed.(10 mins.)

*Evaluation:* Review those literal problems that the participants tried to substitute numerical values. Suggest alternatives.

*Reinforcements:* Complete worksheets 18 and 19

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Week 13: March 30, 1995

*Objectives:* To review the solving of literal equations
To assess personal growth by evaluating their performance on the post test.
To apply concepts of algebra to every day formulas.

*Warm -Up:* *Make a self evaluation chart of the topics that they learned over the past 12 weeks. Each chart can be very different if they wish.*

*Activities:* Read the discussion about the literal equations on page 43. Try to substitute a quantity to make the problem of exercise 9 that will make the solution true.
Complete the post test of the book , make generalizations about your perception of improvement.
Complete the Mastery 3 Test for books one and two.
Read the worksheet on formulas .
Working in pairs complete the answers for the questions and work on the problems.

Develop a formula that may look like an algebraic expression in order to arrive at an answer.
List the formulas that you may use at work or during your everyday life.

*Evaluation:* Review self evaluations on their progress. Evaluate their mastery of the concepts of books 1 and 2.

*Reinforcements:* Complete Worksheet 20.